The Follow Up of the Fibonacci Project, a Case Study

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Abstract

The Center for Science Education and Training – CSET (http://education.inflpr.ro/) at the National Institute for Laser, Plasma and Radiation Physics in Bucharest is member of the European Comenius network INSTEM (http://instem.tibs.at/) formed by 14 institutions aiming to promote inquiry based teaching, to gather innovative teaching methods and to raise students' interest in science as well as offering them careers information in STEM subjects, in order to respond to global challenges in teaching and gender imbalances in STEM education. The present paper presents the results of a case study prepared by the CSET team in the frame of the INSTEM project. The focus of this case study is an analysis on the way the European funded project Fibonacci, targeting the wide dissemination of inquiry-based methods in teaching science and mathematics (IBSME), influenced the science education in Romania after our successful participation to this project. The analysis refers to the national context of science education in which the Romanian participation to the "Fibonacci" project took place and emphasises the major innovative aspects of this European project. The case study underlines the impact of the Fibonacci project on (i) CSET project management approaches; (ii) the new tools used in teachers training; (iii) the Fibonacci resources accessed by teachers' trainers; (iv) the organization of CPD sessions; (v) the development of the national science teachers network and the means they use to collaborate. The participation to the "Fibonacci" project (i) enlarged our horizon on IBSME; (ii) diversified our access to resources; (iii) provided new opportunities to improve our courses for teachers; (iv) assisted us implementing a national community of practice on IBSE; (v) provided a better visibility for our efforts and results at national level; (vi) brought some innovative methods of science teaching in Romania; (vii) offered to us a high status at national level in the field of science education at pre-university level; (viii) multiplied our external contacts and partners; (ix) assisted us in rising the interest of science teachers community on our work.

1. Introduction

The activities supporting science education at pre-university level began at the National Institute for Laser, Plasma and Radiation Physics (Magurele, Romania) in 2003 with its involvement in the EU's Comenius network "Hands-on Science" (http://www.hsci.info/). Over the next ten years CSET run several national and international projects, involving hundreds of school teachers and thousands of school students, all over Romania. The major projects run by CSET are: the national project "Discover!" (http://education.inflpr.ro/ro/Descopera.htm); the FP7 EU project "Fibonacci" (http://education. inflpr.ro/ro/Fibonacci1.htm) ,; the FP7 EU project "Creative Little Scientists" (http://education.inflpr.ro/ro/MiciiCercetatoriCreativi.htm),; the national project "Inquiry-Based Education in Science and Technology - i-BEST" (http://education.inflpr.ro/ro/IBEST.htm),; the LLL EU's Comenius network "INSTEM - Inquiry Network for Science, Technology, Engineering, Mathematics Education" (http://education.inflpr.ro/ro/INSTEM.htm),; the LLL EU's Comenius network "SUSTAIN - Supporting Science Teaching Advancement through Inquiry" (http://education.inflpr.ro/ro/ SUSTAIN.htm), project promoting the education for sustainable development in relation to IBSE.
The "Fibonacci" project gathered 25 entities (universities, research institutes, academies, foundations) from 21 European countries in an effort to design a guide for partners work on inquiry-based education in science and mathematics, and to organize at continent level the dissemination and exchange of good practice. Experts in pedagogical sciences, as well as in science and mathematics teaching and learning were coordinated by a Scientific Committee.
As indicated in the cited "Fibonacci" booklet, the project was based on a set of three pillars defined by the coordinating team to assist project partners in implementing the project philosophy at national stage [1]: (i) by learning through inquiry, students have to understand and adopt concepts, gather evidence on their research and develop critical thinking; (ii) the project encourages local initiative to support education for innovation and sustainability; (iii) an innovative aspect of the "Fibonacci" project resides in the adaptation of a novel, very efficient interaction and dissemination scheme involving actors engaged in running the project – the twinning strategy. Around a network of Reference Centers

(RC), with recognized expertise in inquiry-based education are grouped successively less experienced centers (Twining Centers – TC), which are trained to become centers of excellence through exchange visits, training sessions, and seminars. This cross fertilization approach, we can say was the most powerful tool of the project, as it allowed exchanges of practices, a better understanding of local conditions and limits, formulation of common solutions. In the mean time, this approach helped participants to learn one from another, by exposing them to different educational practices, cultural background and teaching methods.

An interesting outcome is the comparative evaluation, highlighting the communalities and differentiations of inquiry education in science and mathematics, considerations which can be of interest for those trying to go both ways. The project analysis underlined also the consequences of these differentiations between the two for classroom practice. Another significant result of the project is the "Self-Reflection Tool for Teachers" and the "Diagnostic Tool for CPD Providers" designed to assist school teachers in evaluating their inquiry-based understanding and practice, and to help teacher trainers to assess, during the preliminary stage and in the post professional development course, teachers skills, attitudes and advance in relation to inquiry-based (IB) teaching and learning. The tools consist of sets of evaluation and self-evaluation questions designed to support CDP course providers and end-users in their estimations and planning. The set of tools targets either pre-school or primary/ middle school practitioners.

2. Case study analysis

The impact of the Fibonacci project on CSET educational programs will be analyzed in relation to Figure 1, where the scheme of the Fibonacci impact on CSET educational activities is illustrated synthetically. Considering the complexity of the project structure and the number of partners involved there are numerous aspects which impinged on the way activities were run by CSET after the completion of the project. To simplify the review we are performing, the analysis will be carried out over five main directions, with an emphasis on major implications: (i) management; (ii) tools; (iii) resources; (iv) professional development; (v) the Greenwave subproject.

2.1 Management issues

On the management site three directions brought a significant contribution to our future activities: (i) the accommodation with the way the financial management and reporting was imposed through the project; (ii) the conceptual design of educational activities we are planning based on a better understanding of inquiry-based science and mathematics education (IBSME) concepts; (iii) the exercise of team work in preparing the transversal topics booklets.

The project offered to us the possibility to learn about the management and reporting in the case of an ample European project, to reinforce the way we use FP7 forms and to adapt ourselves to other countries practice. On the other side, various forms of evaluation of projects outcomes done by the consulting company (surveys concerning teachers feedback, questionnaires addressed to participants, on site visits to observe the modality we implement the project in Romania) proved to be of real help in focusing our efforts on projects goals and timeline.

The participation to the "Fibonacci" project clarified to us some of the updated concepts on IBSME and accommodated us with various interpretations and practice across Europe [2]. We acquired new knowledge in relation to classroom practice in more advanced countries such as France, UK, Austria, Denmark, Sweden in the field of inquiry applied to science teaching and we had the opportunity to study practical aspects on IBE in mathematics, subject which was not so closed to our work. The materials and demonstrations on this issue offered by the German team proved to be extremely valuable. In relation to the development of the booklet addressing transversal IBSME subjects we participated to the preparation of the "Cross disciplinary approaches" brochure [3]. It was a big challenge and a great opportunity for the Romanian team from several points of view: (i) the subject required a multidisciplinary approach; (ii) the partners involved were redoubtable experts in this filed; (iii) we have to adhere to curriculum practices of other cultures and educational contexts. The production of this material offered countless opportunities for debates and exchange of opinions, in order to devise teaching materials which can be used in different countries, under different circumstances. In the mean time, the various backgrounds of the co-authors and their different perspective on the treated subjects gave way to very original results. In our opinion, the booklet can be considered a model for employing inquiry across curriculum, by the means it integrates different subjects (measuring science, mathematics, geography, history, literacy, paleontology, the use of ICT) to offer a holistic approach in science teaching and learning.

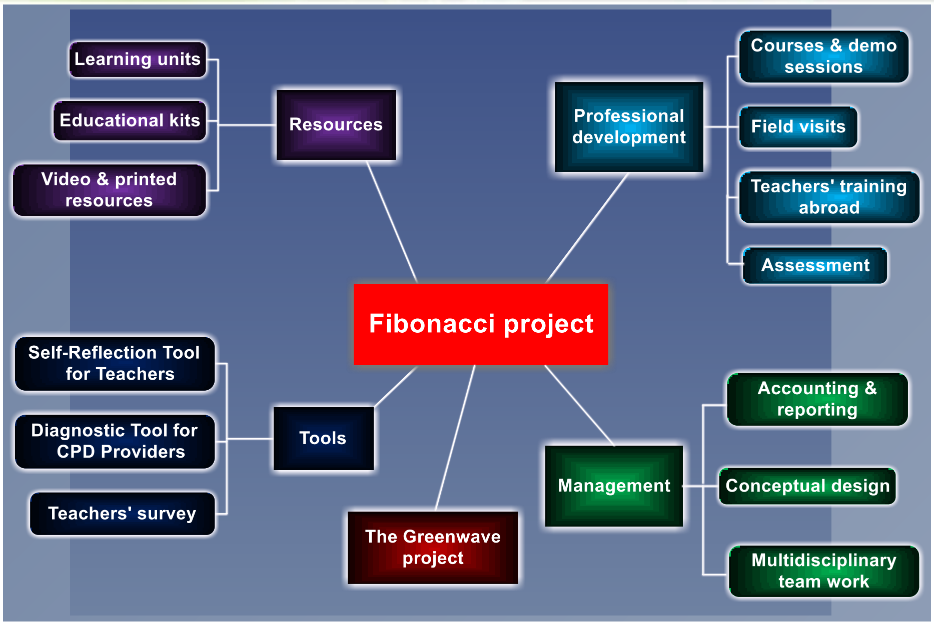

Fig. 1. *The scheme of the Fibonacci impact on CSET educational activities*.

2.2 Fibonacci tools

In order to assist the participants in handling the project and to have an almost “real-time” picture of its development, an extensive teachers’ survey was conducted by the consulting company. Data collected through this survey was used by the evaluators to assemble a vision on the project participants, their background and their vision on inquiry and, in the mean time, facilitated national project coordinators to assess project impact on participants. Based on these surveys results we were able to better estimate our partner schools needs and involvement in the project.

Four additional diagnostic tools were setup by the project experts, two dedicated to pre-school and primary/ middle school teachers and two planned to be used by providers of professional development courses [4]. These tools are collections of questions aiming to facilitate teachers’ trainers or teachers to evaluate the end-users understanding and practice of inquiry, according to the Fibonacci declared and accepted principles mentioned above. The booklet includes instructions for professional development providers on the use of the tools: (i) how to organize an interview with the evaluated teacher; (ii) how to plan and run a classroom visit; (iii) how to observe teacher-pupils interactions; (iv) how to monitor pupils’ activities and results during the lesson; (v) how to collect and interpret acquired data. The complementary material for teachers’ self assessment addresses issues such as: criteria for inquiry practice evaluation; how evidences have to be gathered on: teacher’s role; pupils activities; pupils records; suggestions on reflection, analysis and post assessment action. As the tools have different beneficiaries (kindergarten educators or primary/ middle school teachers) full instructions are given on the way they have to be employed in various school contexts. The questions are grouped in several categories targeting specific inquiry related concepts: (i) “building on pupils' ideas; (ii) supporting pupils' own investigations; (iii) guiding analysis and conclusions; (iv) carrying out investigations; (v) working with others; (vi) records pupils make of their work; (vii) pupils' written records; (viii) guiding children to share ideas.” The document provides also some examples on the way these tools were applied in partner countries, as examples of best practice.

We used these tools in the frame of the national project we are running “Inquiry-Based Education in Science and Technology - i-BEST" to organize two teachers’ survey, one for kindergarten educators and one for primary school teachers. For these activities we translated the Fibonacci tools questionnaires and distributed them to partner school teaches. Based on the answers gathered from kindergarten teachers we already prepared a journal paper, due for publication in the journal of the Romanian Physical Society [5]. According to our knowledge, it is the first time the Fibonacci tools are used on a large scale investigation in a European country.

2.3 Fibonacci resources

As mentioned above, the project partners developed a lot of exemplary teaching resources available from the project web site. Our interaction with Fibonacci project participants implied the translation of some learning units prepared by colleagues from Slovakia, Slovenia, Austria, and France. These translations were either distributed to some schools collaborating with CSET, for being tested, or were posted in the virtual library (http://81.181.130.13/teachscience/) of our Center. Periodically we advertise the new documents which can be accessed on the web site for downloading.

Another aspect concerning our cooperation regarding the available resources refers to the advice we received from some partners in developing our own training kits. In some situations, we bought sets of training aids developed in other countries to act as models for Romanian school teachers.

Of great help proved to be the books on the practice related to inquiry in mathematics education we received from Bulgarian experts. In some instances we run demo sessions on IBSE by using videos provided by the French Foundation “La main à la pâte”.

2.4 Teachers’ professional development

One main line of action of the Fibonacci project was the setup of strategies for teachers’ professional development. Within this context the major direction of work we benefited are related to field visits, demo sessions and courses, debates on modern means to encourage the use of IBSME in European school. The Romanian participants attended several field visits which made possible exchange of ideas, discussions with teachers’ trainers and participation to practical lessons. Besides that these field visits offered the opportunity to visit training facilities, school units and resource centres. All these complex activities provided valuable first hand information on the educational systems in different countries, their science and mathematics curricula, their assessment systems. We learn a lot from these events as far as we had the opportunity to understand various educational approaches, to see the organizational schemes and to catch the educational message of different cultures. On the students achievement assessment we learned about the way formative assessment is done in countries such as Germany, France, Sweden, or UK. It was an important contribution of the project to our own professional development as teacher’s trainers, as far as formative assessment is not so wide spread in Romania.

2.5 The Greenwave subproject

One of the greatest successes of the Fibonacci project in Romania was the Greenwave subproject. Greenwave invited school students over Europe to carry out observation on plants and small animals during the spring time and to report their findings on a central platform. In this way, the information gathered each year between February and May provides an inside view on spring advancement on the continent from South to North and from East to West. Romanian school children were very captivated by this program and more than 1000 participated. The project run over three school years and by the end of the Fibonacci project most of the participants (students and teachers) were very disappointed as their participation was interrupted.

Considering the enthusiasm of our participants we decided to continue this type of collective project and developed in the frame of the national project “Inquiry-Based Education in Science and Technology - i-BEST" the collaborative platform we mentioned before. The national platform was extended by including a multitude of activities: “Spring is coming” - the observation of the growth of plants during spring time; (ii) “Weather and its parameters” – measurements of rainfall, air temperature and wind speed for the characterization of weather during a period of two months; (iii) “Water quality” - the evaluation of the quality of rivers, lakes and household water; (iv) “Sounds” - the estimation of noise pollution and acoustic insulation; (v) “UV radiation hazard” - the investigation of the UV radiation to which the population is exposed. Each school year more than 150 schools spread across Romania enrolled in these investigations.

3. Conclusions

To conclude we can say now that the participation to the Fibonacci project: (i) enlarged our horizon on IBSME; (ii) diversified our access to resources; (iii) provided new opportunities to improve our courses for teachers; (iv) assisted us implementing a national community of practice on IBSE; (v) provided a better visibility for our efforts and results at national level; (vi) brought some innovative methods of science teaching in Romania; (vii) offered us a high status at national level in the field of science education at pre-university level; (viii) multiplied our external contacts and partners; (ix) assisted us in rising the interest of science teachers community on our work.

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